



U.S. Department  
of Transportation  
Federal Aviation  
Administration

# Advisory Circular

**Subject:** CUTOUTS IN A MODIFIED FUSELAGE  
OF SMALL AIRPLANES

**Date:** 8/6/86

**Initiated by:** ACE-100 -

**AC No:** 23-5

**Change:**

1. PURPOSE. This advisory circular provides information and guidance concerning acceptable means, but not the only means, of compliance with Part 23 of the Federal Aviation Regulations (FAR) applicable to the structural substantiation of a fuselage modified by incorporation of large or small cutouts. Accordingly, this material is neither mandatory nor regulatory in nature and does not constitute a regulation.

2. RELATED FAR SECTIONS. Sections 23.301, 23.305, 23.307, 23.571, 23.629, 23.1529, and 23.1581.

3. BACKGROUND. Incorporation of large cutouts in a fuselage is one of the most significant structural modifications made to an airplane. Such modifications include large cargo door cutouts, baggage door cutouts, enlargement of existing doors, installation of oversize windows, etc. Small cutouts in a fuselage cause less of a structural problem. These modifications include such items as camera window cutouts, auxiliary power unit (APU) intake and exhaust cutouts, antenna cutouts, etc.

The redistribution of axial and shear loads, pressure loads, and changes in stiffness and fatigue strength are considerations that should be evaluated. If multiple cutouts are close to one another, superposition of loads may occur.

4. METHOD OF SUBSTANTIATION. One method, but not the only method, for substantiating the structural integrity of a fuselage of a small airplane modified by incorporation of large or small cutouts is as follows:

a. Identify the critical pressure, flight, landing, and ground loads conditions; such as down bending, up bending, torsion, shear, etc., and any combination of these loads.

The loads may be obtained from existing type certification data, if made available by the type certificate holder, or be derived by the applicant.

b. After the loads are identified or derived, complete substantiation of the modified structure should be performed. This may be accomplished by an analysis that shows the strength of the modified structure is equal to, or better than, the strength of the unmodified structure, by a detailed stress analysis, or by a combination of static test to limit load and analysis to ultimate load as limited by § 23.307. Regardless of the method of substantiation for pressurized cabins, pressurization tests should be accomplished after the modification as required by § 23.843(a).

If a static test is used for substantiation, the structure should be inspected after the application of limit load to verify that there is no detrimental permanent set. Any detrimental permanent set would require some redesign.

c. The effects of each structural modification on flutter should be addressed. This may include an analysis or a ground vibration test before and after the modifications are accomplished to ascertain the effect of the cutouts on the vibration characteristics of the airplane. This subject is thoroughly discussed in AC 23.629-1A.

d. A fatigue strength or failsafe strength evaluation for pressurized cabins as required by § 23.571 should be accomplished. This evaluation may indicate that cyclic pressure tests should be run on a fatigue pressure test specimen with the modification incorporated.

e. The Flight Manual and Instructions for Continued Airworthiness (Maintenance Manual) may be affected. Supplements to these manuals should reflect any pertinent changes in performance, flight procedures, maintenance procedures or practices, life limited parts, etc.

f. Use of a compliance checklist, although not required, may be advantageous from an administrative standpoint for major modifications.



BARRY D. CLEMENTS  
Acting Director, Central Region